5. ACCELERATOR SAFETY ENVELOPE

The RHIC Accelerator Safety Envelope (ASE) is a set of physical and administrative bounding conditions based on safety considerations approved by the Department of Energy as required by DOE O 420.2 paragraph 4.b.1 and 4.b.2. The ASE provides specific boundaries within which the accelerator and experiments must operate to provide protection to workers, the public and the environment. The technical basis for the ASE is provided in Chapter 4 of the RHIC SAD.

Implicit in the notion of an ASE is that variations in operating conditions are permitted if and only if they do not exceed the defined boundaries. A variation beyond the boundaries described below shall be treated as a reportable occurrence, as defined by DOE O 232.1A that requires DOE notification.

The following are ASE components for the RHIC Complex. The items are accompanied by some explanatory comments that explain the rational and enforcement strategy.

A. COLLIDER BEAM INTENSITY LIMIT

The following requirements take into consideration the RHIC Design Criteria for Prompt Radiation in Chapter 3, Section D of the RHIC SAD and compliance with 10 CFR 835 and DOE O 5400.5:

In the first year of operation per Appendix 34 of the RHIC SAD:

Au - 60 bunches of 5×10^{8} ions/bunch at 100 GeV/u

Protons - 60 bunches of 5×10^{10} protons/bunch at 250 GeV

Subsequent to the first year and subject to the restrictions in Chapter 4, Section 4.F of the RHIC SAD:

Au - up to 120 bunches of 2×10^{9} ions/bunch at 100 GeV/u

Protons - up to 120 bunches of 2×10^{11} protons/bunch at 250 GeV

B. BEAM LOSSES AND AREA CLASSIFICATIONS

The following requirements take into consideration the RHIC Design Criteria for Prompt Radiation and compliance with 10 CFR 835 and DOE O 5400.5.

1. The location of beam losses determines access restrictions as specified in Appendix 1 of the RHIC SAD. These access restrictions shall apply to the Intersection Region Areas, Thompson Road, Ring Road, roads to and from Ring Road, unfenced portions of the berm.
2. The Collider Center (Building 1005S) shall be maintained as an uncontrolled area.

C. PARTICLE ACCELERATOR SAFETY SYSTEM

1. The safety system operation configuration and maintenance shall be in accordance with RHIC OPM 4.91.
2. The safety system shall be functionally tested every six months. Management may approve a grace period of up to two months.
3. Area radiation monitors shall be calibrated annually, and the interlock portions shall be functionally tested every six months. The locations of monitors shall be maintained as defined by the Radiation Safety Committee (RSC).
4. High intensity proton beam in the W-Line shall be prevented by either the AGS Beam Current Monitors or RSC approved RS-LOTO of Critical Devices. If the AGS Beam Current Monitoring System is unavailable, heavy ion beam operation is permissible.

D. OXYGEN DEFICIENCY HAZARD CONTROL

The density of helium at 50 K is only 10% of the density at the normal operating temperature of the Collider of 4.6 K. Above 50 K the reduction of the oxygen concentration in the Collider Tunnel, in the event of a loss of helium, will not create an oxygen deficiency hazard. Work in the tunnel above 50 K is, therefore, permitted without PASS in operation.

When the temperature of the helium in the Cryogenic System is 50 K or lower, the ODH portion of the PASS System for the Cryogenic System shall be in operation, in conjunction with the associated training and access control procedures.

E. FIRE PROTECTION

1. The Collider magnets and tunnel power supplies can be energized, if the smoke detection system for the energized area can transmit an alarm to summon the Fire/Rescue Group. The transmittal can be automatic or by way of a fire watch in the vicinity.
2. Personnel can occupy the tunnel, if the exhaust fans for the occupied area can be activated automatically or manually for smoke removal.
3. The Fire Protection System shall be functionally tested annually by Plant Engineering.

F. MAIN CONTROL ROOM STAFFING

To restrict operation to an adequate number of qualified personnel in the Main Control Room, as a minimum, one Operations Coordinator and one Operator shall be on duty when beam is in operation.

G. CRYOGENIC CONTROL ROOM STAFFING

When the refrigerator is in operation a watch must be provided in the Cryogenic Control Room, preferably the Cryogenic Shift Supervisor, but qualified Cryogenic Operators can be designated by the Cryogenic Shift Supervisor to be the sole watch stander.

The Cryogenic Shift Supervisor or his/her designee, shall remain in the Cryogenic Control Room at all times. Any work in the field on the cryogenic system shall be in accordance with a two-person rule as required by RHIC OPM 5.1.16.0.1.

H. STAR

Items 1 and 2 minimize the fire and explosion hazards to personnel, equipment and the program.

1. With the presence of flammable gas in the integrated detector positioned in the IR:
   a. Both the STAR and PASS flammable gas detection systems shall be required and functionally tested annually.
   b. The PASS functions of the system shall be functionally tested every six months.

c. The detector ventilation system shall be delivering flow.

d. One of the two building emergency exhaust fans shall be available. The emergency fans shall be functionally tested annually.

e. A quantity of purge gas shall be available to dilute the detector flammable gas volumes below 25% of the LEL. The volume varies by subsystem and is dependent upon the gas mixture currently in use.

f. The TPC gas used in the detector shall be P-10 or equivalent hazard.

g. When the TPC is in operation, no more than 80 cubic meters of methane gas shall be attached to the gas mixing system.

h. A qualified local watch shall be provided as per RHIC OPM 5.4.11.0.

2. In order for the electronics to be powered as an integrated detector in or out of the IR, the Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system shall be required and functionally tested.

I. PHENIX

Items 1, 2 and 3 minimize the fire and explosion hazards to personnel, equipment and the program.

1. In order for the electronics to be powered in the integrated detector:

   a. The electronics racks interlocks in the IR shall be required and functionally tested.

   b. The Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system shall be required and functionally tested.

2. In order for the IR to be occupied by personnel after flammable gas is present, compliance with the Life Safety Code requires the personnel plug door and the emergency escape labyrinth shall be available for egress.

3. With the presence of flammable gas in the integrated detector positioned in the IR:

   a. Both the PHENIX and PASS flammable gas detection systems shall be required and functionally tested annually.

b. The PASS functions of the system shall be functionally tested every six months.

c. The purge air system to each powered electrical cabinet in the IR shall be delivering flow.

d. The building HVAC ventilation shall be delivering flow, and both emergency exhaust fans shall be available. The emergency fans shall be functionally tested annually.

e. A qualified local watch shall be provided per RHIC OPM 5.4.11.0.

f. A quantity of purge gas shall be available to dilute the detector flammable gas volumes below 25% of the LEL. The volume varies by subsystem and is dependent upon the gas mixture currently in use.

g. The detector and ceiling level HSSD systems shall be required and functionally tested.

h. The High Capacity Ventilation System shall be available and functionally tested before the introduction of flammable gas into the RICH.

i. The interstitial space between the RICH and the Pad Chamber FEE shall be inerted when introduction of flammable gas is in the RICH.